Chemistry

Topic: Pollution Of Air And Water

Pollution:- The addition of unwanted and harmful substances to the environment in order to fulfill the needs of food, shelter, clothing, transport and industry by humans; is called as pollution.

Air Pollution: The contamination of air by the addition of unwanted and harmful substances is known as air pollution.

Air Pollutants

The substances which contaminate the air are called air pollutants.

Examples: dust, fly ash, harmful gases such as carbon monoxide (CO) and sulphur dioxide (SO_2).

Types of Air Pollutants

Air pollutants are of two types:

1. Gaseous air pollutants
2. Particulate air pollutants

Gaseous air pollutants:

Pollutants which are in the gaseous state at normal temperature and pressure are called gaseous pollutants.

Examples: SO_2, CO_2, NO_2, CO

Particulate air pollutants:

Pollutants that are in the form of tiny particles are called particulate pollutants. They may be solid or liquid. Particulate matter usually remains suspended in the atmosphere and is therefore also termed as suspended particulate matter (SPM).

Some air pollutants are:

Gaseous pollutants	Particulate pollutants
Sulphur dioxide (SO_2) Carbon monoxide (CO) Carbon dioxide (CO_2) Nitrogen dioxide (NO_2) Ozone (O_3) Hydrogen sulphide (H_2S) Methane (CH_4)	Smoke Dust Sand Cement dust Flyash(coal dust) Asbestos dust Unburnt hydrocarbons Smog (Smoke + fog)

Sources of Air Pollution

The various sources of air pollution can be classified into two groups:-

1. Natural sources of air pollution
2. Man-made sources of air pollution

Natural Sources of Air Pollution:-

i) The blowing of strong winds during dust storms puts dust particles into the air and pollute it.

ii) Forest fire release soot (carbon particles) and ash into the air and pollute the air.

iii) Volcanic eruption releases various gases and ash into the atmosphere.

iv) Decay of organic matter releases ammonia gas into the air.

v) Decay of organic matter lying under water releases methane gas as air pollutant.

vi) The pollen grains released by plants remain floating in the air and pollute it.

The effect of air pollution caused by natural resources on human beings is negligible.

Man-made Sources of Air Pollution

i) *Burning of fuels*: Burning of fuels like wood, cow dung cake, coal and kerosene in homes pollute the air by producing pollutants like carbon monoxide (CO), sulphur dioxide (SO_2), carbon dioxide (CO_2), smoke, soot and ash.

ii) *Vehicles*: Exhaust gases emitted by motor vehicles pollute the air by producing harmful pollutants like sulphur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), unburnt hydrocarbons, lead compounds and soot. Thus, vehicles are the major sources of air pollution in big cities.

iii) *Industries*: Various industries pollute air by releasing pollutants such as $S0_2$, NO_2, chlorine, cement dust, asbestos dust, etc.

iv) *Thermal power plants*: Thermal power plants pollute air by emitting sulphur dioxide ($S0_2$) and fly ash.

v) *Nuclear power plants*: Nuclear power plants pollute air by releasing radioactive radiations.

vi) *Fertilizers and pesticides*:- Use of fertilizers and pesticides in agriculture pollutes the air.

vii)*Deforestation:-* Deforestation pollutes air by increasing the amount of carbon dioxide in it.

viii) *Chlorofluorocarbons* (CFCs):- Use of chlorofluorocarbons pollutes air by depleting the ozone layer. As a result of this, harmful ultraviolet rays reach the earth. CFCs are used in refrigerators, air conditioners and aerosol sprays.

ix) Mining: Mining of coal and stone releases coal dust and stone dust to cause air pollution.

x) Smoking: Smoking pollutes air by emitting carbon monoxide (CO) and nicotine.

Harmful Effects of Air Pollution

Air pollution is like a slow poison. The ill effects of air pollution are not seen immediately, but over a long period of time, the pollutants present in air damage our health and property. The various harmful effects are given below:

i) Respiratory Diseases:- It causes several respiratory diseases such as bronchitis, asthma, lung cancer, tuberculosis, pneumonia, chest pain and allergies.

ii) *Particulate Matter*: Dust and smoke spoil our clothes, reduce visibility and blacken the buildings. Dust and smoke get deposited on the leaves of the plants and thus affect the rate of photosynthesis. They also cause diseases like bronchitis and asthma in human beings. Particles of lead oxide present in automobile exhaust can cause anaemia, brain damage and even death. Particles of mercury cause minamata disease. The minamata disease affects the nervous system and can cause death. It is caused by severe mercury poisoning.

iii) *Hydrogen Sulphide*: Hydrogen sulphide tarnishes silver objects and blackens lead paints and paintings. It smells like a rotten egg. It causes headache in humans when inhaled in large quantity.

iv) *Carbon Monoxide Poisoning*: (Refer to Additional Question)

v) *Depletion of Ozone*:- (Refer to Additional Question)

vi) *Green House Effect*:- (Refer to Additional Question)

vii) *Acid Rain* :- (Refer to Additional Question)

Harmful Effects of Acid Rain

1. Acid rain is very corrosive and harmful for both living and non-living things.
2.It gradually destroys living tissues, eats up cement, limestone and marble of buildings, and corrodes steel and other metals.
3.It is quite harmful for the survival of fishes and other aquatic lives. Several species of fishes have become extinct due to acid rain.
4. Acid rain damages old statues, old monuments, etc.
5. It causes premature leaf fall in plants and makes the soil acidic.

Prevention And Control Of Air Pollution:

Air pollution cannot be totally eliminated. It can however be controlled to minimize its harmful effects. Some of the methods for controlling air pollution are given below:

1. Tall chimneys should be installed in factories to reduce air pollution on the ground level.
2. Better designed fuel burning equipment should be used in homes and industries so that fuel is burnt completely.
3. Reduce vehicular emissions by using non-polluting fuels like CNG.
4. Use LPG for domestic use.
5. Improve the quality of fuel in automobiles and use catalytic converters in them.
6. Make use of renewable alternative sources of energy like solar energy, wind energy and hydro energy.
7. All motor vehicles should be maintained properly so that they comply with pollution norms.
8. Use unleaded petrol.
9. Install electrostatic precipitators in the chimneys of industries.
10 Plant and grow more and more trees.
11. The air pollution from factories, thermal power plants etc can be controlled by washing down their smoke and waste gases with jets of water.

Chipko Moment

The popular movement that took place in the Terai Himalayas in early 70s to prevent the felling of trees by hugging them was called 'Chipko Movement'. It was perhaps the first well known development programme initiated by common people. It started in March 1973, in the remote hill town of Gopeswar in the Chamoli district of Uttrakhand. The movement was led by reputed

environmentalist. Sundar Lai Bahuguna. One interesting aspect of this movement was that the women of the villages were in the forefront to participate in this movement.

Taj Mahal(A Case Study)

The Taj Mahal is located in Agra. It is made of white marble. The effect of pollutants on it has become a matter of concern for archaeologists and environmentalists. Motor vehicles and the industries located in and around Agra for rubber processing, chemicals, iron foundries, and the Mathura oil refinery have been responsible for producing pollutants like SO_2, $N0_2$, smoke, dust, soot etc. These gases react with the rain to form acid rain. Acid rain corrodes the marble of the Taj Mahal. SPM releases from the oil refinery has turned the marble from white to yellow. Taking this into account, the Supreme Court of India has suggested several steps to save the Taj. These are:

1. Switch over to cleaner fuels like CNG and LPG.
2. Use unleaded petrol in the vicinity of Taj Mahal.
3. Shift polluting industries outside the Agra city.

Vana Mahotsava

The Vana Mahotsava programme was started by the Government of India to revive lost forest. It is celebrated throughout the country in the first week of July every year. Every year, lakhs of sapling of different tree species are planted with the active involvement of government agencies. However, it needs to be made more popular, meaningful and effective.

Water Pollution

The contamination of water with unwanted and harmful substances such as sewage, toxic chemicals, industrial wastes, etc, is called water pollution.

Water is said to be polluted when there are undesirable changes in the physical, chemical and biological condition of water that make it unfit for human consumption.

Water Pollutants

The unwanted and harmful substances which pollute water are called water pollutants.

Examples: sewage, industrial waste, synthetic detergents, chemical fertilizers, oils, heavy metals, radioactive waste, etc.

Sources of Water Pollution

The major sources of water pollution are given below:

1. Industrial wastes:- The discharge of untreated, toxic industrial wastes from industries into rivers and lakes are one of the main cause of water pollution. The industrial wastes contain a large number of harmful chemicals including, acids, alkalis and hot water. The harmful chemicals which are released by the industries include arsenic, lead, mercury and cadmium which lead to toxicity in plants and animals.

2. The dumping of sewage into rivers and lakes is the second major cause of water pollution in big cities. Excreta and cattle dung contain several harmful microbes that can cause diseases. This includes all kinds of wastes like human excreta, food waste, soaps and detergents, garbage, wrappers of eatables, plastics and other materials. These materials are carried by flowing water into the water bodies and make them polluted.

3. Fertilizers, pesticides,weedicides: The excessive use of fertilizers, pesticides and weedicides in the soil causes water pollution because some of these chemicals are washed into the rivers and lakes with rainwater. These harmful chemicals may seep through the soil and pollute underground water. Certain pesticides such as DDT can enter the bodies of aquatic animals and eventually reach human beings by way of food chain.

4. Synthetic Detergents:- Excessive use of synthetic detergents for washing purposes produces a lot of foam and pollute water.

5. Petroleum Oil:- The leakage of petroleum oil into sea during drilling and shipping operations pollutes sea water.

Harmful Effects of water Pollution

1. The polluted water contains a number of disease-causing pathogens like bacteria, protozoa and virus which cause water-borne diseases like typhoid, cholera, dysentery, jaundice and hepatitis.

2. The acids and alkalis present in industrial wastes kill those microorganisms which are the natural cleansing agents of water. This hinders the self-purification process in water bodies like rivers and lakes.

3.The sewage and fertilizers present in polluted water are rich in nutrients. This leads to an excessive growth of algae (algal bloom) which cover the whole surface of the water body. This process is called eutrophication. When

the algae die, the decomposers use up all the dissolved oxygen for decomposing the vast amount of dead algae. Since no dissolved oxygen is left in the water of the lake, all the aquatic animals like fish die.
4. The industrial wastes of industries like paper, paint, pesticides, metal, etc. contain toxic chemicals like mercury, lead, copper, cadmium etc. When polluted water is used, those toxic substances can enter the human body through food chains and affect their health. The accumulation of toxic harmful pesticides in the body of human beings is called bioconcentration.

Prevention Of Water Pollution

Water pollution can be prevented or minimized by adopting following measures:-

1. The toxic industrial wastes should be treated chemically to neutralize the harmful substances present in it before discharging into rivers and lakes.
2.The sewage should not be dumped into rivers. It should first be treated at the sewage treatment plant to remove the organic matter from it in the form of manure.
3.The use of excessive fertilizers and pesticides should be avoided.
4.The use of synthetic detergent should be minimized or biodegradable detergents should be used.
5. Dead bodies of human beings and animals should not be thrown into rivers.
6.The excreta and other garbage should be treated in a biogas plant to get fuel as well as manure.
7. The water of rivers, streams, ponds and lakes should be purified or cleaned. This can be done both by the industries and the government. One such example is the Ganga Action Plan launched by the Indian Government.
8. Trees and shrubs should be planted along the banks of the rivers.
9. There should be general awareness among the masses regarding the harmful effects of water pollution and the ways of preventing it.
10.Waste paper, plastics, waste food materials, and rotten food and vegetables should not be thrown into open drains.

Ganga Action Plan

The Ganga is one of the most famous rivers of India. Millions of people depend on it for their daily needs and livelihood. The Ganga has been polluted for many years. The people living near the Ganga river throw large quantities of

garbage, untreated sewage industrial waste, dead bodies, flowers, idols of gods and goddesses, polythene bags, hot water and many other materials directly into the Ganga river. The Ganga is one often most endangered rivers in the world.

The Ganga Action Plant (GAP) was launched in India in 1985. The main aim of this project was to reduce the pollution level in the river. Pollution control activities included under the project were:-

1. Solid waste management.
2. Installation of sewage treatment plant.
3. Installation of crematorium.
4. Development of river front.
5. Provision of low cost sanitary facilities.
6. To create public awareness.

This program has, to a great extent, helped reduce pollution although we still have a long way to go before the river Ganga is absolutely free of pollution. Later on, the Yamuna Action Plan was launched on the same line as the Ganga Action Plan.

Potable Water: Water which is suitable for drinking by human beings is called potable water.

Characteristics of Potable Water

1. It should be colourless, odourless and transparent.
2. It should be pleasant to taste.
3. It should be free from harmful germs and suspended impurities.
4. It should be free from harmful salts such as nitrates, cyanide, urea, etc.
5. It should contain sufficient amount of dissolved oxygen.

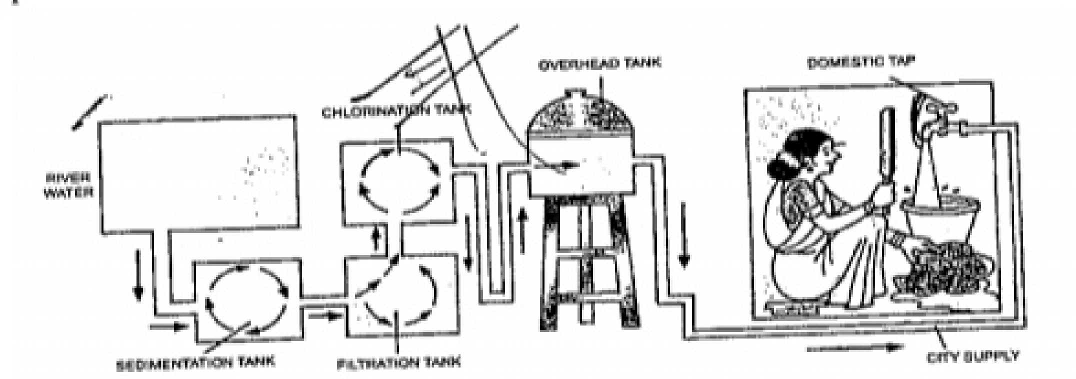
Purification of water

Water supplied in our homes generally comes from rivers which are contaminated with suspended impurities, soluble impurities and pathogens. Therefore, it is necessary to purify this water before it is made available for human use.

Purification of water for City Supply :

People in big cities get purified river or lake water through a network of water pipe lines. The three main processes that water undergoes during purification are sedimentation, filtration, and chlorination. Let us study about these

processes.



Sedimentation: Water is pumped from a river into a large tank and allowed to stand for some time. The heavy suspended particles settle down at the bottom of the tank as sediments. This process is called sedimentation. The upper layer of water is then sent for filtration.

*Filtration:*After sedimentation, the water is filtered through thick layers of sand and gravel. In this process the remaining suspended impurities are removed.

Chlorination: The filtered water is chlorinated by adding chlorine or bleaching powder. Chlorine kills all the harmful germs. This process of adding chlorine to filtered water to kill germs is known as chlorination. The purified and chlorinated water is then supplied for human use through a network of pipes.

Purification of water at Homes: In villages and small towns water supply is not available. People in such places get their water from wells, hand pumps, rivers, lakes, ponds and springs. Water from these sources may not be fit for drinking and other purposes. The following methods can be used for purifying water at domestic levels:

i) *Boiling*:- Water is boiled for about 10 minutes in order to kill harmful microbes.

ii)*Treating water with some chemicals*:- Chemicals like potassium permanganate, bleaching powder and chlorine tablets can be used to kill harmful germs in water.

iii) *Filtration*: Water can be purified by passing through layers of sand, gravel and charcoal.

Domestic Water Filter

The simplest form of domestic water filter consists of a porous candle made

up of clay or ceramics. The water passes through the candle. The candle retains solid impurities but allows clear water to pass through it. The filter should be cleaned periodically or replaced after a long use.

Ultraviolet Filter

Special modern water purifiers are nowadays used. In these filters, water is first made to flow through a porous candle which filters mud, dust and other solid impurities. The filtered water then passes through an activated carbon filter which removes colour and odour. Finally, the water passes through the ultraviolet rays. These rays kill harmful microbes present in it. Thus, the water becomes safe for drinking.

(TEXTUAL QUESTIONS)

Ql. What are the different ways in which water gets contaminated?

Ans. Water gets contaminated in following ways:

- i) Many industries discharge harmful chemicals into rivers and streams.
- ii) Chemical fertilizers, pesticides and weedicides used in agriculture dissolve in water and are washed into water bodies from the fields.
- iii) Throwing of untreated sewage directly into rivers.
- iv) Many industries release hot water into rivers.

Q2. At an individual level, how can you help reduce air pollution?

Ans. At individual level, we can do following things to reduce air pollution:

i) Use CNG and unleaded petrol instead of ordinary petrol and diesel.

ii) Use public transport as far as possible.

iii) Generate awareness about air pollution by talking to our family members and friends.

iv) Plant trees and nurture the ones already present in the neighbourhood.

Q3. Clear, transparent water is always fit for drinking. Comment.

Ans. No, water which looks clean may still have disease-carrying microorganisms and dissolved impurities. Hence, it is not always fit for drinking and it is essential to purify water before drinking.

Q4. You are a member of the municipal body of your town. Make a list of measures that would help your town to ensure the supply of clean water to all its residents.

Ans. Following are some of the measures that would help our town to ensure the supply of clear water to all its residents:

i. Make the supply system leak proof as a lot of drinking water is being wasted through the leakages.
ii. Proper cleaning of the water tank.
iii. Chlorine tablets should be made available.
iv. The water supply pipes should not come in contact with the sewage pipes.

Q5. Explain the differences between pure air and polluted air.

Ans. Air is a mixture of gases. Pure air contains about 78% (by volume) nitrogen, 21% oxygen and small but definite amount of carbon dioxide, argon, methane, ozone, water vapour etc. When the air is contaminated by unwanted substances which have a harmful effect on both the living and non-living components, it is called polluted air.

Q6. Explain circumstances leading to acid rain. How does acid rain affect us?

Ans. Pollutants like sulphur dioxide and nitrogen dioxide react with the water vapour present in the atmosphere to form sulphuric acid and nitric acid. These come down with the rain, making the rain acidic. This is called acid rain. Acid rain affects us in many ways. e.g.

i) Acid rain removes basic nutrients such as calcium from the soil.
ii) It increases corrosion of metals
iii) It damages buildings and sculptural materials.
iv) The low pH of acid rain water changes the rate of metabolism of organisms.
v) It causes damage to fresh water life e.g., decrease in fish population of lakes.
vi) It causes premature leaf fall in plants and makes the soil acidic.

Q7. Which of the following is not a greenhouse gas?........

Ans. Nitrogen

Q8 Why does the increased level of nutrients in the water affect the survival of aquatic organisms?

Ans. Chemicals used as fertilizers in agriculture dissolve in water and are washed into water bodies from the field. The excessive quantities of chemicals like nitrates and phosphates which are present in fertilizers act as nutrients

for algae to flourish. Once these algae die, they serve as food for decomposers like bacteria. They use up a lot of oxygen. This results in decrease in the oxygen level which is harmful for the survival of other organisms.

(ADDITIONAL QUESTIONS)

Q9. What is the chemical nature of acid rain? What arc the harmful effects of acid rain?

Ans. Much of the oxides of nitrogen and sulphur emitted in the atmosphere react with water droplets to form the corresponding acids. Sulphur dioxide forms sulphuric acid and nitrogen dioxide forms nitric acid. These acids dissolve in rain water and fall as 'acid rain'.



$2SO_2 + O_2 \rightarrow 2SO_3$

Sulphur dioxide Sulphur trioxide



$2SO_3 + H2O \rightarrow H_2SO_4$

Sulphuric acid



$4NO_2 + O_2 + 2H_2O$ --------------->-$4HNO_3$

Nitrogen dioxide Nitric acid

Effects of Acid Rain

The main effects of acid rain are:

i) Acid rain removes basic nutrients such as calcium from the soil.

ii) It increases corrosion of metals.

iii) It damages buildings and sculptural materials.

iv) The low pH of acid rain water changes the rate of metabolism of organisms.

v) It causes damage to fresh water life e.g., decrease in fish population of lakes.

vi) It causes premature leaf fall in plants and makes the soil acidic.

Q10. What is greenhouse effect? State its significance for us.

Ans. The concentration of carbon dioxide in the atmosphere is increasing due to the current global trend in deforestation and increasing combustion of fossil fuels. A part of the sunlight incident on the earth is reflected back in the form of infrared light. This infrared light is absorbed by the carbon dioxide molecules. Hence the envelope of CO_2 of the atmospheric air would be able to trap larger proportion of the infrared light if the concentration of CO_2 is

increased, thereby heating the atmosphere. This heating of the atmosphere due to the absorption of infrared radiations by CO_2 molecules is called the greenhouse effect. This will ultimately increase earth's temperature and may cause melting of glacier and thereby flooding the coastal plains.

Q11. What are the causes of indoor air pollution? How can we prevent or minimize it?

Ans. Indoor air pollution means the pollution of air due to human activities inside home. The use of paints, aerosols, acids for cleaning toilets, sprays and deodorants, carpet cleaners, objects made from recycled plastics etc. produces vapours which are quite harmful for our health. Indoor pollution can be minimized by flushing fresh air after the use of above activities.

Q12. Define suspended particulate matter (SPM). Name five particulate matters present in air.

Ans. Suspended particulate matter in the atmosphere means fine solid and liquid particles suspended in air. The size of these particles varies from 1 micron to 10 microns. The particulates are categorized according to size, source or their physical state.The following particulates are present in the atmosphere:

i) *Dust*:- Solid particles ($10^6\mu$) suspended in gaseous medium temporarily. These particles do not disperse but settle down after some time.

ii *Droplet*:- Small liquid structures floating in air. These fall down when air is still.

iii) *Fly ash*:- Partially burnt particles of fossil fuels flown into air.

iy *Fog*:- Condensed water vapour suspended in air near the surface of the earth.

v) *Fumes*:- Liquid evaporates and turn into gaseous form which again condense over air particles.

vi) *Aerosols*:-Small solid or liquid particles dispersed in air.

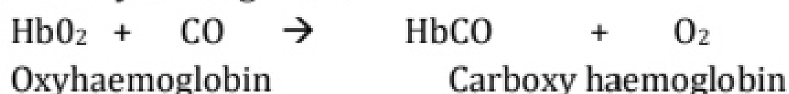
Q13. Carbon monoxide is a colourless and odourless gas and even then it is a pollutant in blood?

OR

How does a very small quantity of carbon monoxide cause oxygen deficiency in blood?

Ans. Carbon monoxide is formed by the incomplete combustion of carbon

containing materials and from the burning of petrol or kerosene. It has no adverse effect on vegetation, visibility of material objects, but it has great affinity to form complexes with haemoglobin as compared to oxygen. Therefore, even small amount of carbon monoxide is able to displace a considerable amount of oxygen from oxyhaemoglobin to form the carboxyhaemoglobin.



$HbO_2 + CO \rightarrow HbCO + O_2$

Oxyhaemoglobin　　　　Carboxy haemoglobin

Thus, the transport of oxygen from the lungs to the tissues is impaired. This can affect heart and brain and even lead to death. The effect of carbon monoxide poisoning can be removed if pure oxygen is inhaled immediately.

Q1.4 State why a car parked in the sunshine with its windows closed is found much hotter inside than outside?

Ans. The inside of a car with its windows closed is hotter than outside due to greenhouse effect. The window panes absorb infrared radiations of the sun making inside hotter because heat rays are absorbed by glass easily and are not allowed to reflect back.

Q15. What are greenhouse gases? How does these affect our environment? What do you suggest to control the effect of greenhouse gases?

Ans.Carbon dioxide, water vapour, methane, nitrous oxide and the chlorofluorocarbons (CFCs) are called greenhouse gases. The increased presence of these gases in the environment causes global warming. Burning of fossil fuels such as coal, oil and the natural gas is the main source of greenhouse gases. Therefore, to minimize greenhouse effect or to monitor global warming, burning of fossil fuels should be controlled.

Q16. "Hot water can also be a pollutant" explain. How?

Ans. Hot water is usually water from power plants and industries. It is released into rivers. It raises the temperature of the water body, adversely affecting the animals and plants living in it.

Q17. What is global warming?

Ans. The phenomenon of rise of average atmospheric temperature due to continuous increase in the concentration of green house gases in the atmosphere is called global warming. It is caused due to the following reasons:

i) Burning of fossil fuels in home, industries and automobiles by man.

ii) Methane added to the atmosphere by marshes, paddy, fields etc.

iii) Chlorofluorocarbons (CFC's) emitted into the atmosphere by refrigerators and air conditioners

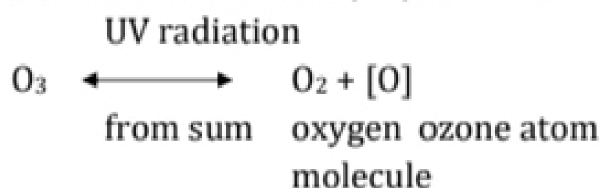
iv) Nitrous oxide produced from organic matter and fertilizers by bacteria and from automobile exhausts and industries.

Due to all these causes, there is slow rise in the atmospheric temperature which has adverse effect on climate, food production and results in rise in sea level due to melting of glaciers thereby submerging number of low lying area/ islands.

Q18. Write short notes on ozone layer depletion.

Ans. a) *Ozone Layer*:-Ozone is a form of oxygen. It is a triatomic molecule made up of three atoms of oxygen O_3. Ozone is highly poisonous. Very little quantity of ozone is present in the lower part of atmosphere, called troposphere. However, good amount of ozone is present in the upper part of atmosphere called stratosphere. This rich zone of ozone in the stratosphere is called ozone layer or ozonosphere. It is also commonly called ozone shield or ozone blanket.

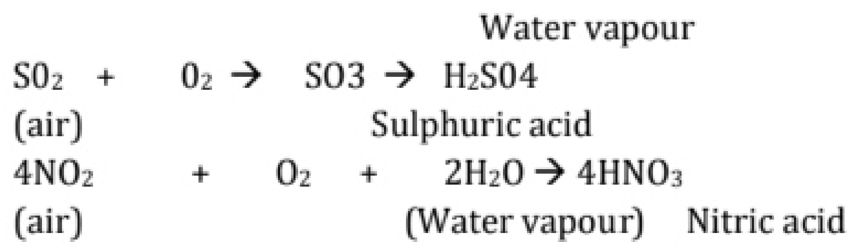
In the stratosphere, ozone is broken and generated simultaneously by the absorption of harmful ultraviolet (UV) radiations coming from the sun:



b) *Ozone layer depletion*:- The decline in thickness of ozone layer is called as ozone layer depletion. Ozone is being depleted by air pollutants like CFC's CH_4 (methane)and oxides of nitrogen (NO_X) which leads to ozone hole i.e. decline in thickness of ozone layer over a restricted area. Ozone hole was first discovered over Antartica in 1985. It causes following harmful effects on man, animals and plants. Cancers, Eyesight defects like cataract, lowering of body's immune system, decline of photosynthesis in plants and global warming.

Q14. Define acidic gases. Give examples. Can you observe its effect on newly constructed building made of marble?

Ans. Those gases which combine with water and form acids are called acidic gases. For example, sulphur dioxide (SO_2) and nitrogen dioxide (NO_2).



Effects of buildings made of marble:- Marble is actually 'calcium carbonate'. The polluted air containing SO2 and NO2 produce acid rain. The acid so obtained is quite dilute and reacts with calcium carbonate stone very slowly and thus the damage caused would be noticed after a long time. Thus the effects of acidic gases on newly constructed marble buildings will be seen after a long time.

Chemical effects of electric current:

Metals such as copper, aluminium are good conductors of electricity while material like rubber plastics are bad conductors of electricity. In the case of liquids, some liquids are good conductors of electricity while a few are bad conductors of electricity. The water obtained from sources such as pumps, wells, ponds and tap are not pure and contain several dissolved salts. Such water is a good conductor of electricity. While distilled water is free of salt and is a bad conductor of electricity.

Chemical effects of electric current

Passage of current through chemical solutions causes chemical reactions to take place.

Chemical effects include:

- Formation of gas bubbles at electrodes
- Deposition of metals at electrodes
- Changes in solution colour

Electrolysis is the process by which ionic substances are decomposed into simpler substances when an electric current is passed through them.

Conductor

Any material that allows an electric current to pass through it is known as a conductor. Eg: metals like copper

Insulator (Bad Conductors)

Materials that do not allow the free flow of an electric current through it are known as bad conductors or insulators. Eg: Rubber, plastic.

Electric circuit

- A closed-loop path which a current take is known as an electric circuit.
- When the path of the circuit is closed, the current flows through it, but when there is a break in the path (switch is open) then, the circuit is open and, is not conducting.

Tester

A tester is a piece of electrical equipment used to check the presence of electric current. It is usually a conductor with a led/bulb to indicate that the current is present in the circuit.

Current – Conducting Liquids

Conducting Liquid

- Liquids conduct electricity too when there are salts dissolved in the liquid.
- Most liquids that conduct electricity are solutions of acids, bases or salts.

Acids, bases and salts

- Acids and bases are chemical substances that dissociate to form ions when dissolved in a solution. They are a good conductor of electricity because of the presence of the ions.
- Salts when dissolved in water also conduct as they release positive/negatively charged ions.

Conduction of electricity in the water

- Distilled water is a bad conductor of electricity because of the absence of dissolved salts and minerals.
- Water starts conducting when acids, bases or salts are dissolved that releases ions, which conduct when a potential difference is applied.

Electrodes and electrolyte

- A conductor, when immersed in a solution with its end connected to the terminals of a battery, thereby completing a circuit, is called as an electrode. There are usually 2 electrodes→ cathode(-ve) and anode(+ve).
- An electrolyte is a solution in which the electrodes are submerged. They dissociate on the passage of electric current.
- The electrodes, electrolyte and the battery together form the electrochemical/electrolytic cell.

Electroplating

- The process of depositing a layer of desired metal on another material by means of electricity is known as electroplating.
- Example: Using Copper Sulphate solution as electrolyte and copper electrodes. Copper is electroplated on the negative electrode. The Cu in the solution is replenished due to the addition of copper ions from the positive electrode.

Applications of Electroplating

- Coating zinc on the iron to prevent corrosion and rust.
- Coating silver and gold for jewellery.
- Coating tin onto iron for cans as tin is less reactive than iron.
- Chromium coating for car parts, bath fittings as it has a shiny appearance.
- **Textual Questions**

  1. Fill in the blanks.

  (a) Most liquids that conduct electricity are solutions of , _____________ and _____________.

  (b) The passage of an electric current through a solution causes _____________ effects.

(c) If you pass current through copper sulphate solution, copper gets deposited on the plate connected to the __________terminal of the battery.

(d) The process of depositing a layer of any desired metal on another material by means of electricity is called ________.

Ans:

(a) Most liquids that conduct electricity are solutions of **acids, bases** and **salts.**

(b) The passage of an electric current through a solution causes **chemical** effects.

(c) If you pass current through copper sulphate solution, copper gets deposited on the plate connected to the **negative** terminal of the battery.

(d) The process of depositing a layer of any desired metal on another material by means of electricity is called **electroplating.**

2. When the free ends of a tester are dipped into a solution, the magnetic needle shows deflection. Can you explain the reason?

Ans: The compass needle shows a deflection which concludes that current is flowing through the wire. The circuit becomes complete as the free ends of the tester are immersed inside the solution. So, the solution is conducting solution hence deflection is obtained in the compass needle.

3. Name three liquids, which when tested in the manner shown in Fig.14.9, may cause the magnetic needle to deflect.

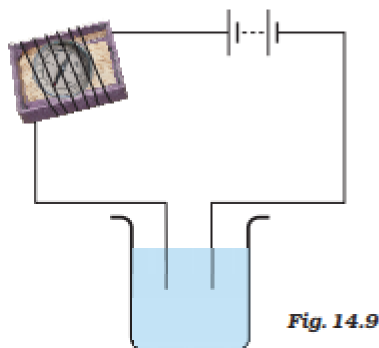


Fig. 14.9

Ans:

I. Saltwater

II. Lemon juice

III. Vegetable oil

These liquids can be taken in a beaker to show the passage of electricity as they will show a deflection in the magnetic needle.

4. The bulb does not glow in the setup shown in Fig.14.10. List the possible reasons. Explain your answer.

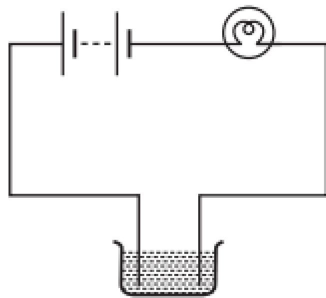


Fig. 14.10

Ans: The possibility of the bulb not glowing maybe because of the following reasons:

a. The liquid may be non-conducting. In this case, the circuit is incomplete and the current does not pass through the liquid.

b. Electric current may be weak for the circuit is made up of a material which is not a good conductor of electricity or there is insufficient energy in the battery to generate electricity.

5. A tester is used to check the conduction of electricity through two liquids, labelled A and B. It is found that the bulb of the tester glows brightly for liquid A while it glows very dimly for liquid B. You would conclude that

(i) liquid A is a better conductor than liquid B.

(ii) liquid B is a better conductor than liquid A.

(iii) both liquids are equally conducting.

(iv) conducting properties of liquid cannot be compared in this manner.

Ans: Liquid A is a better conductor than liquid B.

The conductivity of the solution determines the amount of current flowing through the solution. Greater the conductivity, greater will be the quantity current passing through the solution and lesser the

conductivity, the quantity of current passing through will be correspondingly less. So, the conductivity of liquid A is more than the conductivity of liquid B.

6. Does pure water conduct electricity? If not, what can we do to make it conducting?

Ans: Pure water does not conduct electricity as it does not contain any type of salts. Adding, a small amount of Common salt (Sodium Chloride i.e.,.NaCl) will turn the water to a conducting medium.

7. In case of a fire, before the firemen use the water hoses, they shut off the main electrical supply for the area. Explain why they do this.

Ans: In case of a fire, before the firemen use the water hoses, they shut off the main electrical supply for the area because water sprayed from the hose might conduct electricity which may come in contact with the electrical appliances which increases the chance of electricity passing through wire. This may hurt the fireman.

8. A child staying in a coastal region tests the drinking water and also the seawater with his tester. He finds that the compass needle deflects more in the case of seawater. Can you explain the reason?

Ans: The amount of dissolved salts present in the seawater is more than that of the drinking water. So, the sea water will be a better conductor than the drinking water. That is the reason behind the increased deflection of the needle in the seawater when compared with the drinking water.

9. Is it safe for the electrician to carry out electrical repairs outdoors during heavy downpour? Explain.

Ans: No. It is not safe to repair electrical appliances outdoors during a heavy downpour. Rainwater is composed of a certain percentage of dissolved salts making it conductive. This may cause electric shocks and harm the electrician while working outdoors during heavy downpours.

10. Paheli had heard that rainwater is as good as distilled water. So she collected some rainwater in a clean glass tumbler and tested it using a tester. To her surprise she found that the compass needle showed deflection. What could be the reasons?

Ans: Rainwater is composed of a certain percentage of dissolved salts making it conductive. This makes the deflection in the compass.

11. Prepare a list of objects around you that are electroplated.

Ans: Chromium plating: This is done on exterior parts of automobiles in order to obtain a shiny appearance.

Gold Plating: Silver ornaments are coated with a thin layer of gold and the product are called Gold-plated Ornaments.

Zinc Plating: Iron used for Construction are coated with a Zinc layer in order to protect them from corrosion and rusting.

12. The process that you saw in Activity 14.7 is used for purification of copper. A thin plate of pure copper and a thick rod of impure copper are used as electrodes. Copper from impure rod is sought to be transfered to the thin copper plate. Which electrode should be attached to the positive terminal of the battery and why?

Ans: The thick rod of impure copper plate is to be attached to the positive terminal of the battery because when electric current is passed through the copper sulphate solution, it gets dissociated into copper and sulphate. The free copper, being positively charged, gets drawn to the negative terminal of the battery and gets deposited on it. On the other hand the loss of copper from the solution is regained from the impure copper rod which is attached to the positive terminal of the battery.

Topic: Combustion and Flame

1. *List the conditions under which combustion can take place.*
   a. There are three essential conditions for combustion to take place:
      i. Presence of a combustible substance.
      ii. Presence of supporter of combustion i.e. oxygen.
      iii. Attainment of ignition temperature.
2. *Fill in the blanks: Do it yourself*
3. *Explain how the use of CNG in automobiles has reduced pollution in our cities?*
   a. CNG is cheap, readily available and highly combustible. It has a high calorific value. The use of CNG in automobiles has reduced pollution in our cities because it produces the harmful products in very small amount and it is a cleaner fuel as it does not produce harmful gases and does not leave any residue after burning.
4. *'Compare LPG and wood as fuels.*
   a. Following are the differences between wood and L.P.G:

LPG	Wood
It doesn't leave any residue after burning.	It leaves behind lot of ash after burning.
It can be transported through pipelines and cylinders.	It cannot be transported easily like LPG.
It burns easily.	It catches fire with difficulty.
It has low ignition temperature.	It has high ignition temperature.
It doesn't produce smoke on burning.	It burns with smoke.

5. *Give reason:*
   a. *Water is not used to control fires involving electrical equipment.*
      i. Water is not used to control fires involving electrical equipments because water is a good conductor of electricity and can result in an electric shock to a person in contact with water.
   b. *LPG is a better domestic fuel than wood.*
      i. LPG is a better domestic fuel than wood because it neither produces gases nor leaves residue that pollute the environment. Besides, LPG has high calorific value than wood.
   c. *Paper by itself catches fire easily whereas a piece of paper wrapped around an aluminium pipe doesn't.*
      i. Paper by itself catches fire easily because its ignition temperature is low, while a piece of paper wrapped around an aluminium pipe doesn't catch fire because its ignition temperature is high.
6. *Name the unit in which calorific value of a fuel is expressed.*

   a. The unit in which calorific value of a fuel is expressed is kilojoules per kilogram (KJ/Kg).

7. *Explain how CO_2 is able to control fires.*
   a. $C0_2$ being heavier than oxygen, covers the fire like a blanket and also brings down the temperature of combustible substance. Since the contact between the combustible substance and oxygen is cut off, the fire is controlled.
8. *It is difficult to burn a heap of green leaves but dry leaves catch fire easily. Why?*
   a. It is difficult to burn a heap of green leaves because its ignition temperature is high, but dry leaves catch fire easily as their ignition temperature drops or becomes low.
9. *Which zone of a flame does a goldsmith use for melting gold and silver and why?*
   a. A goldsmith uses the outermost zone of a flame for melting gold and silver because it is the hottest zone of the flame (temperature = 800 C).
10. *In an experiment 4.5kg of a fuel was completely burnt. The heat produced was measured to be 1,80,000KJ. Calculate the calorific value of the fuel.*

Ans. Calorific value = KJ/Kg.

$$\frac{1{,}80{,}OOOKJ}{4.5kg} = 40{,}OOOKJ/Kg.$$

11. *Can the process of rusting be called combustion? Discuss.*
    a. The process of rusting can be called as combustion because iron is oxidized and energy is released but this happens so slowly that we cannot see it happening.
12. *Abida and Ramesh were doing an experiment in which water was to be heated in a beaker. Abida kept the beaker near the wick in the yellow part of the candle flame. Ramesh kept the beaker in the outermost part of a flame. Whose water will get heated in a shorter time?*
    a. Ramesh's water will get heated in shorter time.

Additional Questions

1. Define the following:-
   a. *Combustion* **:-** The process of burning of a substance in presence of oxygen with the evolution of heat and light, is called combustion e.g. when a magnesium ribbon is heated, it combines with oxygen to form magnesium oxide along with a liberation of heat and light



$$Mg + O_2 \rightarrow MgO + Heat + Light$$

b. *Combustible substance*:- The substances that can react with oxygen and give off heat and light, are called combustible substances e.g. wood, paper, kerosene etc.
c. *Inflammable substance*:- The substances which have very low ignition temperature and can easily catch fire with a flame, are called inflammable substances.
d. *Ignition temperature* (*Kindling temperature*):- The minimum temperature, to which a substance must be heated in order to catch fire, is called ignition temperature.
e. *Calorific value of fuel*:- The amount of heat energy liberated by burning 1kg of fuel completely in oxygen is called calorific value of a fuel. Calorific value of the fuels is expressed in kilojoules per kg e.g. C.V of coal is 25,000-33,000 kj/kg.
f. *Flame*:- It is a zone of combustion of gaseous substances with the evolution of heat and light.
g. *Fuel*:- A fuel is a material that is burnt to produce heat and other forms of energy.

2. *What are the different types of combustion?*
   a. According to speed of combustion, it is of following types:
      i. *Rapid combustion*:- It is a type of combustion in which large amount of heat and light are produced in short period of time. E.g. burning of gas in a burner or kerosene in a stove.
      ii. *Slow combustion*:- It is a type of combustion which takes place slowly and at a lower temperature e.g. Rusting of iron, oxidation of food in our body.
      iii. *Spontaneous combustion*:- It is a type of combustion in which substance catches fire as soon as it is exposed to air e.g. burning of white phosphorous.
      iv. *Explosion*:- A reaction involving release of tremendous amount of heat, light and sound in a very short interval of time is called explosion e.g. burning of a fire cracker, combustion of hydrogen.

Depending upon the availability of oxygen, it is classified as:

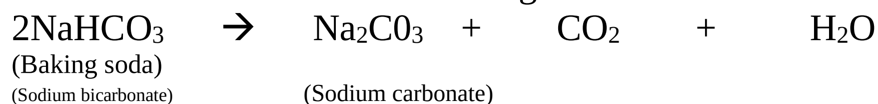
a. *Complete combustion*:- When a substance burns in sufficient supply of oxygen, it burns completely producing large amount heat and light. It is called as complete combustion.

b. *Incomplete combustion*:-When a substance burns in limited supply of oxygen, it burns incompletely producing carbon monoxide, water and less amount of heat. It also produces soot which contains unburnt carbon particles.

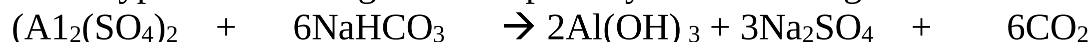
3. *What are the conditions necessary for combustion to take place?*
   a. There are three conditions which are necessary for combustion to take place. These are:-
      i. Presence of combustible substance:- The presence of combustible substance is necessary for combustion to take place. A combustible substance is actually the food for fire.
      ii. Presence of supporter of combustion:- Substances only burn in sufficient supply of air i.e. oxygen. If the supply of air is hindered the substance will not burn.
      iii. Heating the combustible substance to its ignition temperature:- Before combustible substance can catch fire and burn, it must be heated to a certain minimum temperature by supplying heat from outside. The lowest temperature at which a substance catches fire and starts burning is called its ignition temperature.
4. *What is a fire extinguisher and what are the different types of fire extinguishers?*
   a. A fire extinguisher is a device that is used to extinguish fire by the release of $C0_2$. A fire extinguisher extinguishes fire by applying following principles:-
      i. By lowering temperature
      ii. By cutting supply of oxygen
      iii. By removing the combustible substance

There are three types of fire extinguishers that are commonly used:

1) *Dry powder fire extinguisher*:- It contains sand and baking soda ($NaHCO_3$). When this mixture is thrown over fire, baking soda decomposes to release carbon-dioxide which extinguishes the fire.

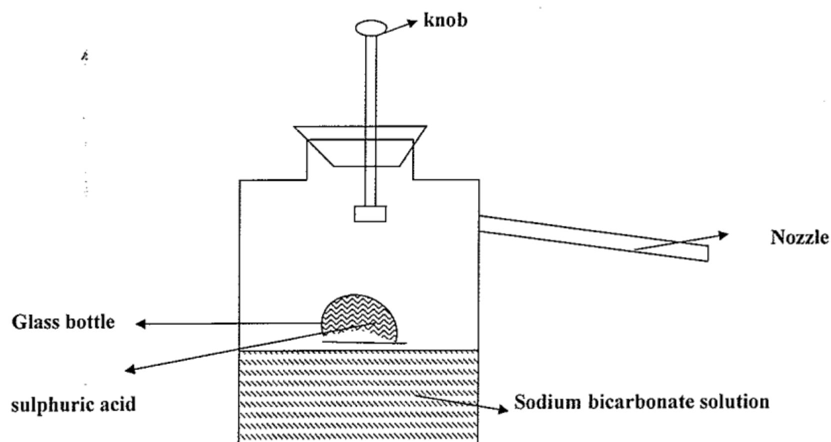


2) *Soda acid type fire extinguisher*:- It consists of small glass bottle filled with sulphuric acid that is supported in a strong iron vessel containing sodium bicarbonate solution. On striking the knob, the acid bottle breaks and carbon dioxide is released.
3) *Foam type fire extinguisher*:- In this type, a solution of aluminium sulphate is taken in glass bottle, instead of sulphuric acid. It gives off foam of carbon dioxide that surrounds the burning substance and cuts off its air supply. This type of fire extinguisher is specially used to extinguish oil fires.



4) Carbon tetrachloride fire extinguisher:- In this extinguisher, carbon tetra

chloride is pumped out from the cylinder and it vapourises and thus extinguishes the fire by inhibiting the combustion process. The vapours of carbon tetrachloride being heavier than air settles on combustible substance and covers its surface and thus cuts its contact with oxygen.



SODA ACID FIRE EXTINGUISHER

5) Define fuel. What are the characteristics of an ideal fuel?
   a. A fuel is a substance that is used to produce heat or energy by burning. The characteristics of an ideal fuel are:-
      i. It should be cheap and readily available.
      ii. It should have high calorific value.
      iii. It should be easy to store, handle and transport.
      iv. It shouldn't produce toxic fumes or smoke.
      v. It should not leave behind excess of ash.
      vi. It should have convenient ignition temperature.
6) Write a detailed note on the different types of fuel.
   a. On the basis of state, fuels are classified as solid, liquid and gaseous fuels
      i. Solid fuels:-These are the fuels which occur in solid state. Coal, wood, coke etc. Solid fuels require much space for storage, give out smoke and leave ash on burning.
      ii. Liquid fuels:- These are the fuels which occur in liquid state e.g. petrol, kerosene, diesel etc. They leave no residue when burnt and can be stored easily.
      iii. Gaseous fuels:- They are fuels which occur in gaseous state e.g. natural gas, petroleum gas, water gas etc. They have high calorific value, leave no residue when burnt, don't cause pollution and have low ignition temperatures. However, they are difficult to store and transport.

On the basis of occurrence fuels are classified as :

- Natural fuels:- These are also called as a primary fuels. These are the fuels that exist in nature and are used in the same form e.g. coal, wood, cow dung.
- Processed fuels:- These are also called secondary fuels. These are the fuels that are produced from natural fuels after processing by chemical methods e.g. petrol, diesel, biogas etc.

7) *Define flame. What are the different parts of a candle flame?*

   a. It is a zone of combustion of gaseous substances accompanied by evolution of heat and light. Only that substance which burn and vapourise produces flame. The combustible substance and the supporter of combustion should be both in gaseous state in order to produce flame. A flame is the visible light emitting gaseous part of fire. It is a highly exothermic reaction. The different pa-ts of a candle flame are:-

      i. Zone of non-combustion (Dark zone):- This is the dark zone that lies around the wick. It contains unburnt gas particles. No combustion takes place here as no oxygen is available.

      ii. Zone of incomplete combustion (Luminous zone):- In this zone, the hydrocarbons present in wax decompose into carbon and hydrogen. The unburnt carbon particles impart a yellow colour to the flame.

      iii. Zone of complete combustion (Non -luminous zone):- It is the outermost hottest region in the flame that is invisible. Here, carbon and hydrogen are completely oxidized to carbon dioxide and water vapour.

      iv. Blue zone:- It lies at the bottom of the flame. The blue colour is due to the burning of carbon monoxide produced due to the incomplete combustion of carbon particles.

8) Write a detail note on :-

Pollution caused by burning of carbon fuels:- Burning of fuels containing carbon also cause serious health problems. When the fuel is burnt, the un-burnt particles of carbon remains suspended in the atmosphere, and causes respiratory problems. Asthma is respiratory disease that has become common these days. Sometimes incomplete combustion takes place due to limited supply of 0_2 resulting in the formation of CO (carbon monoxide) which may even prove to be fatal. Sulphur and nitrogen oxides released during the combustion of fuels dissolve in rain water and cause acid rain. Acid rain is a very harmful for crops, buildings and soil. The decoloration of Taj Mahal over the years is because of acid rain. Carbon dioxide is released when fuel is

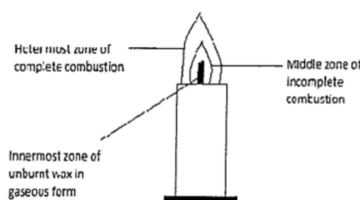
burnt which leads to global warming. Global warming is the rise in temperature of atmosphere of the earth. These result, in the melting of polar glaciers, which leads to a rise in sea level, causing floods in the coastal areas. Low tying coastal areas may even be permanently sub merged under water.

Flame:- A flame is a zone where the burning of gases or vapour takes place with the production of light and i.e. A flame results due to the rapid combustion of fuel.

The fuels burn with a blue flame, when there is sufficient supply of air. But when the supply of air is inadequate, colour of the flame is yellow. Only those solid and liquid substances which vaporize on heating burn with a flame, when a fuel burns completely, a flame without smoke is obtained. If the fuel is not completely burnt, smoking flame is obtained. The smoke contains unburnt carbon particles (soot)

Q) *How does a candle burn?*

a) A candle is made of paraffin waxes that contain hydrocarbons. When they are heated, the hydrocarbons melt. The liquid hydrocarbons are converted to vapour which catch fire and produce a flame. Flame of candle has three different zones:-



Zones of Flame (Zones of candle flame):

1. *The Innermost Zone (Dark Zone)*:- The inner most zone of the flame is cooler than other zones and it is dark. It contains the fuel (wax) in the gaseous state. In this zone, no oxygen is available for the burning to take piace. If we place one end of a glass tube in the dark zone and hold a burning matchstick near the other end, the vapours of unburnt fuel coming out at the other end will burn.
2. *The Middle Zone*:- This is the largest zone of the flame. It is also called as luminous zone. It is brightest zone. In this zone, the fuel burns partially and forms carbon particles. The hot carbon particles emit light. This zone gives soot and smoke.
3. *The Outermost Zone or Non luminous zone*:- This zone of the flame is thin and blue in colour. As the oxygen from the air is readily available in this zone, there is complete combustion of the fuel. This is the hottest zone of the flame. The temperature in this zone is maximum around 1800°C.

Global Warming:- It is the heating up of earth due to the rise in temperature. It happens when green house gases ($C0_2$, Water vapour, Methane) trap heat and light from the sun in the earths atmosphere, which increases the temperature. The heat and light can get through the atmosphere, but it can't get out. As a result, the temperature

rises. This phenomenon is termed as green house effect.
The atmosphere covers earth's surface it allows solar radiations to pass through it to strike the earth surface. However, it presents the infra red radiation to reflect back from earth and to escape into space. Gases like CO_2, methane are called green house gases. Out of these CO_2 is the most important. They help to keep the earth warm. The mean average temperature of the earth is around 15°C. In the absence of green house gases, it may drop to -26°C killing all the life on earth.
Man is adding large amount of CO_2 and CH_4 to the atmosphere burning of fossil fuels in homes, industries. Also deforestation increases CO_2 in atmosphere as there are no trees to utilize this $C0_2$. So, the concentration of green house gases increases and more and more heating of earth's surface takes place. This is known as Global Warming.
Effects of Global Warming:

1. It causes an increase in the sea level due to melting of glaciers, polar rice.
2. It causes climatic changes in environment.
3. It changes precipitation patterns.

Metals & Non-Metals

Physical Properties of Metals & Non-Metals.

1. Metals are generally solid in nature at room temperature except Mercury and Gallium which are liquid at room temperature.

Non-Metals can exist in all three states of matter generally they are present in solid and gaseous state at room temperature e.g. Hydrogen, O_2 etc exist in gaseous state, Iodine, carbon exists in solid state, Bromine in liquid state.

2. Hardness;- Metals are hard in nature. Hardness varies from one metal to another.

Non -Metals are very soft except Diamond which is a form of carbon and is very hard. Graphite another form of carbon is very soft in nature.

3. Lustre:- The shining property of metals is called metallic luster. Metals reflect about 99% of light ; falling on them that is why they appear shiny.

Non-metals are non- lustrous and are dull coloured except Graphite and Iodine.

4. Density:- Metals have high density while non-metals have low density except some elements. Lithium (metals) has very low density.

5. Melting & Boiling points:- Metals have high melting and boiling points because they are tightly (their molecules) packed so in order to break their boundaries high energy is required. Tungsten has highest melting and boiling point.

Non-metals have low melting and boiling point except Graphite which has high melting point. Silicon and Boron have high boiling points.

6. Malleability:- Metals are highly malleable e.g. Gold and Silver. Non -metals are non-malleable but i they are brittle because they break on hammering.

7. Ductility:- Metals are highly ductile e.g. Gold, Silver and Aluminium. Non Metals are non-ductile and break on stretching.

8. Tensile strength: Metals generally have tensile strength. They can be stretched to some degree without breaking except Zinc and Arsenic.

It is because of the most tensile strength of metals we use these in construction. Non-metals have low tensile strength.

***9.* Conductivity:-** Metals are good conductors of electricity because of the presence of free electrons in their last shell.

Silver is the best conductor of electricity followed by copper, gold, Tungsten. However, Iron, Mercury and Bromine are poor conductors of heat and electricity. Non-Metals are poor conductors of electricity except Graphite.

10. Sonorousity:- Metals produce sound on striking with hard object. Because of this property they are used in bells.

Non-metals are non-sonorous.

Chemical properties of metals and non-metals;

1. Reaction with 0_2 (air);

Metals react with 0_2 under different conditions and result in the formation of oxide. (Basic oxide).

Metal + O_2 → Metal oxide

Basic oxide

The oxide that turns red-litmus paper blue

E.g. Mg + O_2 → MgO (Magnesium oxide)

Or on oxide which reacts with acid to form salt and water.

e.g. MgO + HCl → $MgCl_2$ + H_2O
Salt Water

Examples of metals

Sodium (Na), Potassium (K), Calcium (Ca)

These react at room temperature.

Mg, Zinc → react on strong heating.

Iron, copper → react on prolonged heating.

Activity which shows that magnesium forms a basic oxide (MgO) on burning in air.

Magnesium is a metal. We will take a magnesium wire, hold it with a pair of tongs and heat it over a flame. Magnesium wire burns producing magnesium oxide. We will put this magnesium oxide in a boiling tube, then add a little water in the boiling tube and shake it. We will find that MgO dissolves in water partially. We will add some red litmus solution to the boiling tube and observe the change in colour. We will see that red litmus solution turns blue. This shows that MgO is basic in nature (because only basic substances turn red litmus to blue).

Rusting of iron

The reaction of iron metal with oxygen of air takes place in nature. During the rusting of iron, iron metal combines slowly with the O_2 of air in the presence of water (moisture) to form a compound called 'iron oxide'. This iron oxide is rust.

Iron + Oxygen + Water → Iron oxide (Fe)
O_2 H_2O Fe_2O_3(Rust)
(A basic oxide)

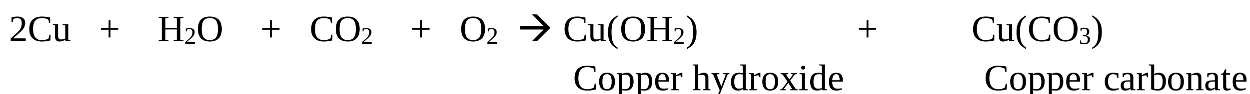
Activity to show that iron oxide is basic in nature

Take at spoonful of rust (from rusted object) in a test-tube, add a little of water and shake it well. In this wav, we will get a suspension of iron oxide in water. Test this suspension of iron

oxide with blue litmus paper'and red litmus paper one by one. We will find that the red litmus paper turns blue. This shows that iron-oxide is basic in nature.

Rusting of copper

When copper object is exposed to moist air for a long time, the copper reacts with H_2O, CO_2 and O_2 present in moist air to form a green-coating on the copper object. The green coating is a mixture of copper hydroxide (Cu (OH_2)) and copper carbonate ($CuCO_3$) which is formed by the action of moist air on copper object.



$2Cu + H_2O + CO_2 + O_2 \rightarrow Cu(OH_2) + Cu(CO_3)$

Copper hydroxide Copper carbonate

Thus, when a copper vessel is exposed to moist air for a long time, it acquires a green coating on its surface. The mixture of copper hydroxide and copper carbonate which forms the green coating is commonly known as 'basic copper carbonate'. If we make a suspension of a little of green coating in water and test it with litmus paper, we will find that it turns red litmus paper to blue. This shows that the green coating formed on copper vessel is basic in nature. The formation of green coating of basic copper carbonate on surface of copper objects on exposure to moist air is called corrosion of copper.

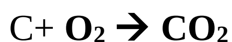
Reaction of Non-Metal with O_2

When non-metals react with $\mathbf{O_2}$ they result in the formation of two types of oxides.

1. Acidic oxide —> turns blue litmus red.
2. Neutral oxides

E.g. $H_2 + 0_2 \rightarrow H_2O \rightarrow$ neutral oxide

E.g. when carbon is burnt in the sufficient supply of air it results in the formation of CO_2



C+ $\mathbf{O_2 \rightarrow CO_2}$

When we dissolve CO_2 in water it results in the formation of carbonic acid.



$CO_2 + H_2O \rightarrow H_2CO_3$ (Carbonic acid)

2. When carbon is burnt in insufficient supply of air it results in the formation of



C+ $\mathbf{O_2 \rightarrow}$ **CO (carbon monoxide)**

E.g. Sulphur is made to react with O_2

$S+O_2 \rightarrow SO_2$ (Sulphur dioxide). Then this SO_2 is dissolved in water.



$\mathbf{SO_2 + H_2O \rightarrow H_2SO_4}$ (Sulphuric acid)

Activity which shows that sulphur forms an acidic oxide ($S0_2$) **on burning in air.**

Sulphur is a non-metal. We take a small amount of sulphur powder in a spoon and heat it over a flame. As-soon as sulphur starts burning with a blue flame, we introduce the spoon in a gas jar and allow the sulphur to burn inside the gas jar. Cover the jar with a lid to prevent the gas being formed from escaping. Sulphur burns in the air of gas jar to form sulphur dioxide. Remove the

spoon from the gas jar. Now, put some water in the gas jar, cover it with a lid and shake it to dissolve sulphur dioxide. Add some blue litmus solution to the gas jar. We will see blue litmus solution turns red. This shows that sulphur dioxide is acidic in nature.

- If an element forms a basic oxide then the element will be a metal.
- If an element forms an acidic oxide then the element will be a non-metal.

Reaction of metal with water

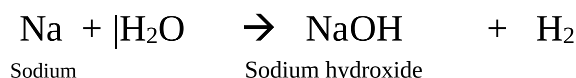
When metals react with water it result in the formation of metal-oxide, metal-hydroxide and H_2 gas. The intensity of reaction depends on reactivity of metal.

Metals react with water under four conditions:-

1. Some metals react with cold water.
2. Some metals react with hot/ boiling water.
3. Some metals react with steam.
4. Some metals do not react at all.

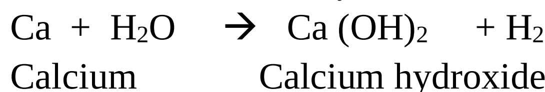
Reaction of metals with cold water

Some metals are highly reactive. So they react violently even with cold water. As they can replace hydrogen very quickly from H_2O in order to give H_2 gas and some other products. E.g. Na, Ca, K



$Na + H_2O \rightarrow NaOH + H_2$

Sodium Sodium hydroxide



$Ca + H_2O \rightarrow Ca(OH)_2 + H_2$

Calcium Calcium hydroxide



$K + H_2O \rightarrow KOH + H_2$

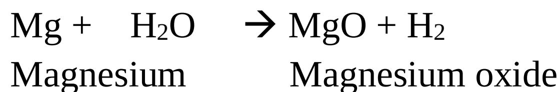
Potassium Potassium hydroxide

Sodium, Ca and K are highly reactive. They can react with water, O_2 and other gases present in air. So if these are kept exposed to air, these will react with the various components of air and get spoiled. In order to prevent their reaction which H_2O these are always stored in Kerosene.

Reaction of metals with boiling water

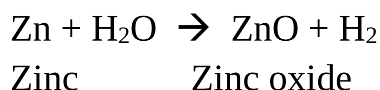
Some metals like magnesium and zinc are less reactive.

They can displace hydrogen from H_2O in the presence of boiling H_2O and form their oxides with the liberation of hydrogen gas.



$Mg + H_2O \rightarrow MgO + H_2$

Magnesium Magnesium oxide



$Zn + H_2O \rightarrow ZnO + H_2$

Zinc Zinc oxide

Reaction of metals with steam.

Some metals like Iron and Nickel are less reactive and can react slowly even with steam.

Iron doesn't react with H_2O under ordinary conditions. This reaction occurs only when steam is passed over red hot iron and the products are Ferric and Ferrous oxides along with the liberation of H_2 gas.



$3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$

Ferrous and ferric oxide:($FeO+Fe_2O_3$)

Some metals do not react at all:

Some metals like copper, silver and gold do not react at all.



$Cu + H_2O \rightarrow Cu_2O + H_2$

Reactivity of Sodium:-

We cut a small piece of Na metal carefully and dry it between the folds of a filter paper. This piece of Na metal is: placed in water filled in a beaker. We will find that the piece of Na metal starts moving in H_2O making of hissing sound due to formation of bubbles of a gas and reacts with H_2O. Soon the piece of Na catches fire. When the reaction stops, touch the beaker we will feel the beaker to be somewhat hot. This is because heat is produced in this reaction. If we test the solution with red and blue litmus paper one by one, we will find it turns red litmus blue. This shows that the solution formed is basic in nature.

Reaction of Non-metals with H_2O

Non-metals do not react with H_2O because;

1. They can't displace H_2 from H_2O.
2. They do not donate electrons.

Some non-metals are highly reactive in nature e.g. phosphorous.

1. Why is sodium stored in Kerosene?

Ans. Sodium is extremely reactive metal. It oxidizes rapidly in air and reacts violently with water. Kerosene prevents the sodium from coming in contact with air, H_2O or other substances that might oxidize it. Besides, Kerosene does not allow the moisture to penetrate through it. We can store them in mineral oils.

2. Why do we store highly reactive metals in mineral oils?

Ans. We store highly reactive metals in mineral oils so that it can't absorb H_2O readily or react with air.

3. Why is phosphorous stored in H_2O?

Ans. Phosphorous is stored in H_2O because it will ignite on contact with air to give dense white fumes. Besides, it is insoluble in H_2O.



$P_4 + 5O_2 \rightarrow P_4O_{10}$

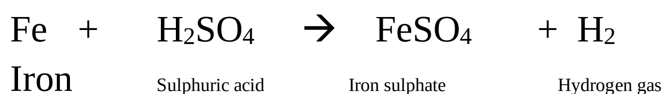
Reaction of metals with acids:-

Metals that can displace H_2 from water can react with dilute acids and result in the formation of salt and H_2 gas.

E.g. Na, Fe, Zn, Mg:- These are highly reactive metals and can displace H_2 from HC1 and H_2SO_4 acid and form their respective chlorides and sulphates.

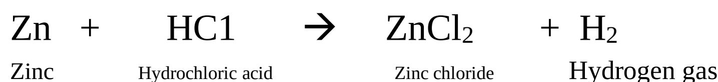
$Na + HCl \rightarrow NaCl + H_2$

Sodium Sodium chloride Hydrogen gas



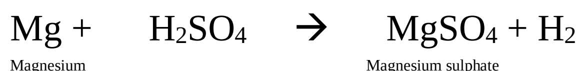
$Fe + H_2SO_4 \rightarrow FeSO_4 + H_2$

Iron Sulphuric acid Iron sulphate Hydrogen gas



$Zn + HC1 \rightarrow ZnCl_2 + H_2$

Zinc Hydrochloric acid Zinc chloride Hydrogen gas



$Mg + H_2SO_4 \rightarrow MgSO_4 + H_2$

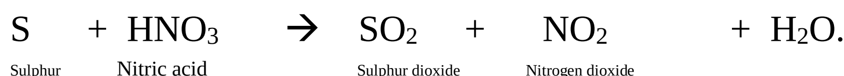
Magnesium Magnesium sulphate

Metals like Cu, Gold, Silver are noble gas metals they don't react at all.

Reaction of Non-metals with acids

Non-metals do not react with acids because they can't displace H_2 from acids.

But some metals like sulphur react with hot and concentrated nitric acid but no H_2 gas is produced.



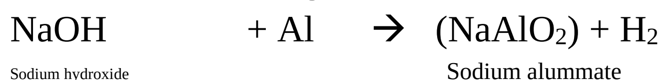
$S + HNO_3 \rightarrow SO_2 + NO_2 + H_2O.$

Sulphur Nitric acid Sulphur dioxide Nitrogen dioxide

The reactions of metals with acids have some important applications in our daily life. Certain foodstuffs like citric fruit juices, pickles contain acids, when they are kept in iron or copper containers. The acids present in them react with the metal of the container slowly to form toxic salts.

Reaction of metals with bases

Some metals do not react with bases, except Al, Zn, Pb are metals which react with strong bases to form salt and H_2 gas.



$NaOH + Al \rightarrow (NaAlO_2) + H_2$

Sodium hydroxide Sodium alummate

Non-metals do not react with bases if some of them will react with bases no H_2 gas will be produced only salt is formed.

Reactivity series of metals

Some metals are chemically very reactive whereas other metals are less reactive or unreactive. On the basis of vigour of reaction of various metals with O_2, H_2O and acids. The metals have been arranged in a group of series according to their chemical re-activities. The arrangement of metals in a vertical column in the order of decreasing re-activities is called reactivity/ activity

series of metals. In this series the most reactive metal is placed at the top whereas the least reactive metals is placed at the bottom.

Potassium (K) ------------------------ Most reactive metal
Sodium (Na)
Calcium (Ca)
Magnesium (Mg)
Aluminium (Al)
Zinc (Zn)
Iron (Fe)
Lead (Pb)
Copper (Cu)
Silver (Ag)
Gold (Au) -----------------------Least reactive metal

Displacement reaction

A reaction in which a highly reactive metal displaces a less reactive metal from its salt solution is called displacement reaction. E.g. Displacement of copper from $CuSO_4$ by reactive metal likes iron and zinc.



$CuS0_4 + Fe \rightarrow FeSO_4 + Cu.$

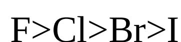
1. Displacement of silver from silver nitrate ($AgNO_3$) by copper metal.



$2AgNO_3 + Cu \rightarrow Cu(NO_3)_2 + 2Ag$

Non- Metals

In non-metals as well more reactive non-metal displaces a less reactive non-metals from its salt solution. This is observed in Halogen family in which



F>Cl>Br>I



E.g.KBr + Cl -» KC1 + Br

Pot. Bromide + Chlorine Pot. Chloride + Bromine

Uses of metals

1 Copper and aluminium are used to make wires to conduct electricity.

2. Iron, copper and aluminium metals are used to make cooking utensils and water boils for factories.

3. Aluminium foils are used for packing medicines, chocolates, food items and many other materials.

4. Aluminium metal is used to make aeroplanes.

5. Mercury is used for making thermometers.

6. Silver and gold are used to make jewellers and ornaments.

7. Iron is used to make nails, screw, pipes etc.
8. Iron is the constituent of haemoglobin and magnesium is a constituent of chlorophyll.
9. Tin is used for making utensils and electric fuse wires.
10. Zn is used for galvanizing iron to protect it from rusting.
11. Lead is used for making water pipes, bullets etc.
12. Gold and silver Amalgam are used for filling tooth cavities.

Uses of Non-Metals

1. Phosphorous is used in manufacturing of fertilizers matchsticks, rat poison, alloy etc.
2. Sulphur is used for making plastics, synthetic, fibres, dyes, explosives, drugs, vulcanization of I rubber, fertilizers , germicides etc.
3. Powdered graphite is used as a dry lubricant. It is used for making graphite electrodes in dry cells. It is also used for making core of pencils called pencil leads.
4. Sand (silica) is used for making glass and cement.
5. N_2 is used for manufacturing Ammonia, HNO_3 etc.
6. Silicon is used for making silicon steel alloy.
7. H2 is used as a fuel for making ammonia, hydrochloride acids and vegetable ghee.
8. Cl is used for bleaching and sterilizing HbO.
9. Iodine is used for making iodized salts and tincture iodine.
10. O_2 is used for respiration and combination.

<u>Textual Questions</u>

Do Q1, Q2, Q3 and Q4 yourself.

Q5) -Some properties are listed in the following table. Distinguish between metals and non-metals on the basis of these properties

Properties	Metals	Non-metals
Appearance Hardness Malleability Ductility Heat conduction Conduction of electricity		
Properties	**Metals**	**Non-metals**
Appearance Hardness Malleability Ductility	Have metallic luster Hard Malleable Ductile	Non-metals are dull Soft Not malleable Not ductile

Heat conduction Conduction of electricity	Good conductor Good conductors	Bad conductor Bad conductor/insulator

Q6 Give reasons for the following:

a) Aluminium foils are used to wrap food items

Ans Aluminium is highly malleable metal and it is very easy to make aluminium foil in comparison to other metals

b) Immersion rods for heating liquids are made up of metallic Substances

Ans. Immersion rods are made up of metallic substances because metals are good conductors of heat and electricity

c) Copper cannot displace zinc from its salt solution.

Ans Copper cannot displace zinc from its solution because zinc is more reactive than copper.

d) Sodium and potassium are stored in kerosene.

Ans. Sodium and potassium metals are very reactive because they react with oxygen and water easily. A lot of heat is produced in the reaction, so sodium and potassium are always stored in kerosene.

Q7 **Can you store lemon pickle in aluminium utensils? Explain.**

Ans. No this is because lemon juice contains acid which can react with aluminium and make it harmful for human consumption.

Do Q8 yourself.

Q9 What happens when

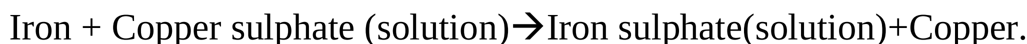
(a) Dilute sulphuric acid is poured on a copper plate?

Ans. Copper sulphate is formed and hydrogen gas is liberated.



(b) Iron nails are placed in copper sulphate solution?

Ans Brown coating is deposited on the iron nails. This is because of displacement of copper from copper sulphate solution by iron.



Q10 Sarish took a piece of burning charcoal and collected the gas evolved in a test tube

i) How will she find the nature of the gas?

She will bring a wet litmus paper in contact with the gas. If the gas turns wet blue litmus paper Into red, the gas will be acidic.

ii) Write down word equations of all the reactions taking place in this process.

- Carbon + Oxygen →Carbon dioxide.
- Carbon dioxide + Water→Carbonic acid.

Qll One day Reeta went to a jeweller's shop with her mother. Her mother gave an old gold jewellery to -the goldsmith to polish. Next **day when they brought the jewellery back, they found that there was a slight loss in its weight. Can you suggest a reason for the loss in weight?**

Ans The jeweller's dip the jewellery in the solution of acid, which reacts with the outer covering of metals. Thus there is a net loss of weight in the metal of the ornament.

Q12 Why is phosphorus stored in water?

Ans Phosphorus is a very reactive non-metal. It catches fire if exposed to air so, in order to prevent contact of phosphorus with atmospheric oxygen, it is stored in water.

Q13 Why sodium metal is stored in kerosene?

Ans Sodium metal is very reactive. It reacts vigorously with oxygen and water. A lot of heat is generated in the reaction. It is therefore, stored in kerosene

ADDITIONAL IMPORTANT QUESTIONS

Ql Name some metalloids.

Ans Arsenic,antimony,silicon and germanium.

Q2 **Why is aluminium used in making airplanes?**

Ans Aluminium mixed with other metals gives a hard substances with a low density and is,therefore,very suitable in making airplanes.

Q3 How much light is reflected back by mirrors coated with silver?

Ans 90%

Q4 **What are coinage metals?**

Ans Metals that are used for making coins are called coinage metals. Copper, nickel, zinc etc. are coinage

metals. Nowadays coins are made from suitable combinations of these metals.

Q5 **Why does an aluminium vessel loose its shine so soon after use?**

Ans Aluminium is a reactive metal. As it comes in contact with air, it forms a dull layer of aluminium oxide on its surface hence looses its shine.

Q6 Silver does not combine easily with oxygen but silver jewellery tarnishes after sometime. Why?

Ans Silver does not combine with oxygen easily but jewellery exposed to atmosphere tarnishes after sometime because it reacts with gases like hydrogen sulphide in air to from silver sulphide which is black.

Q7 **Talking the example of magnesium and sulphur explain how metals and non-metals produce oxides with different characteristics.**

Ans i) Magnesium is metal.lt burns in oxygen to produce basic magnesium oxide. MgO. When it is added to water, it produces a magnesium hydroxide which turns red litmus solution blue.

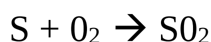


$2MgO \rightarrow 2MgO$



$MgO + H_2O \rightarrow Mg(OH)_2$

ii) Sulphur is a non-metal. With oxygen, it forms acidic oxide,SO_2. It gets changed into sulphurous acid,H_2SO3 on reacting with water. This turns blue litmus solution red. Red litmus solution remains unaffected.



$S + 0_2 \rightarrow S0_2$



$SO_2 + H_2O \rightarrow H_2SO_3$

Q8 Give reasons for the following:

- Silver is used in making mirrors.
- Aluminium is used to make electrical wires.
- Foodstuffs with acid components should not be stored in aluminium utensils.
- Iron is used in constructing bridges and houses.
- Graphite is used as an electrode in the dry cell.
- Iron sheets are galvanized before use.

Ans

i. Silver has a high reflecting power.
ii. Aluminium is a good conductor of electricity.
iii. Acids react with aluminium.
iv. Iron is a hard, strong and rigid metal.
v. Graphite is a good conductor of electricity.
vi. Iron on exposure to atmosphere gets rusted.

<u>OBJECTIVE TYPE QUESTIONS</u>

- Noble gases are found in(free state/compound forms).
- Non-metals are generally (malleable/brittle).
- Potassium after combustion will form (acidic oxide/basic oxide).
- (Iodine/bromine) has antiseptic properties.
- German silver has (copper/silver)as major constituent.

TRUE OR FALSE

- Sodium is more reactive than magnesium. T
- Magnesium reacts with cold water. F
- All metals exist in solid form at room temperature. F
- Gallium has a low melting point. T
- Gold is alloyed with copper to make it hard. T.

Coal And Petroleum Additional Questions

Q1*Define the following:*

i) Carbonisation:-The slow conversion of wood into coal by biochemical processes extending over millions of years is called carbonization.

ii) Fossils: - The dead remains of plants and animals preserved in the earth, are called as fossils,

iii) **Fossil fuels: -** The fuels that are preserved in the earth as the remains of plants and animals are called fossil fuels.

iv) **Destructive distillation:-**The process due to which complex carbon compounds on heating in a closed vessel, in absence of air, decomposes into simpler compounds is called destructive distillation.

v)Petroleum refining:- The process of separating various constituents or fractions of petroleum is known as petroleum refining.

vi) **Fractional distillation:-** It is a method of separation of mixture of liquids of different boiling points by condensing their vapours at controlled temperature, is called fractional distillation,

vii) **Petrochemicals:-**The organic compounds prepared from the various fractions obtained from petroleum and natural gas are called as petrochemicals. For example methyl alcohol, ethyl alcohol, benzene,acetone, acetic acid etc.

Petrochemicals are very important because they are used to manufacture a wide range of useful products. For example

detergents, synthetic fibre, plastic, synthetic rubber, drugs,dyes, fertilizers, perfumes, insecticides, explosives etc.

viii) **Calorific value;-**It is the amount of heat energy produced by burning 1kg of fuel completely in air.

ix) **Global warming:-**The average increase in the temperature of the earth due to green house gases is called global warming.

Q2 *Discuss in detail about the fractional distillation of crude petroleum.*

Ans. Crude petroleum is heated to a temperature of 400°C or slightly

above it in a furnace. The vapours of petroleum are fed into a tall fractionating column near its bottom. As the vapours rise up in the column, they lose heat and hence their temperature drops. Thus,

fractionating column maintains itself at different temperatures which decrease in magnitude in upward direction. Due to this difference in temperature, the vapours with higher boiling point condense first but the vapours with lower boiling point rise up and condense in different parts of fractionating column. The vapours which do not liquefy are taken out from the top of fractionating column.

Fractions Of Petroleum

a) Residual oil:-It is subjected to fractional distillation above 400°C when the following products are obtained.

i) Bitumen:-It is black and sticky semi solid. It is non- volatile in nature.

Uses

- It is used for surfacing of roads.
- It is used in paints.

ii) Paraffin wax:-It is white semi solid having boiling point above 400° C.

Uses

• It is used for making Vaseline and ointments.

• It is used for making candles.

• It is used for making wax papers, matchsticks etc.

• It is used as grease.

• It is used for making cosmetics.

iii) Lubricating oil:- It is thick viscous oil.

Uses

- It is used for lubricating machines.

b) **Fuel oil:-**It is mixture of hydrocarbons. Boiling point varies from 350°C to 400°C.

Uses:

• It is used as an industrial fuel.

• It is used for raising steam in boilers.

c) **Diesel oil:-**It is a mixture of hydrocarbons. Boiling point varies from 250 C to 350 C.

Uses:

• It is used to run heavy vehicles such as buses, trucks etc.

• It is used to run engines for lifting water for fields.

• It is used to run generators for providing electricity.

d) **Kerosene oil:-**It is a mixture of hydrocarbons. Boiling point varies from 170°C t o 250°C.

Uses

• It is used as a household fuel.

• It is used as an illuminant.

• In purified form, it is used as aviation fuel.

e)**Gasoline or petrol:-**It is a mixture of hydrocarbons. Boiling point varies from 40°C -170°C.

Uses:

• It is used as fuel for light vehicles.

• It is used as dry cleaning fluid.

• It is used for preparing petrol gas which is used in laboratories.

f) **Petroleum gas:-**It is a gaseous mixture of hydrocarbons. The boiling point is below 40°C.

Uses

• Petroleum gas is liquefied under pressure and marketed in steel cylinders as liquefied petroleum gas (L.P.G). It is thus used as a household fuel.

• It is used in the manufacture of petrol.

Q3)*Write a note on the mineral resources (fuels) in Jammu and Kashmir.*

Ans. The important minerals resources (fuels) in Jammu and Kashmir are:

i) Coal ii) Petroleum and natural gas iii)Lignite

Coal is found in Jammu province while as lignite is found in Kashmir province.

Coal:-This most important resource is found in Jammu division. The coal belt extends from Jungalgali to Jigni over a distance of 36 miles.

The important coal fields on western side are found in Kalkote, Metka and Mahagali. In addition, the coal belt of good quantity and quality is located on east of Kotli on the fringes of Great limestone formation where hundred millions tones of coal are reported to exist. Production of coal ranges from 9,000 to 10,000 million tones per annum.

Petroleum and Natural gas: - Some resources of natural gas and

petroleum are found near Nowshera, Dharmasthal and some areas of Ram Nagar Tehsil. Very little quantity of petroleum is discovered near Surinsar area.

Lignite:-The deposits have been found in Handwara, Raithan, Oiodrr in Kashmir Valley.

Q4)*Give the geological distribution of coal producing areas of J&K.*

Ans. Geologists have distributed coal producing areas of J&K into

two groups: **Group A: - (With western sector)**

i) Kolakote area (Sair Block) ii) Tata Pani Block,

iii) Jigni Block iv) Mahagala

Group B: - (Central Sector) Chakkar- Chakha - Jangalgali

i| Chakkar area chokri, Sujjanpur, Kalimiti.

ii) Sangarmarg- Chinkhar (Panshasa, Paddar and Thakrakot).

iii) Jangalgali (lain, Gouri, Mitti, Thalival, AnjiKhad to Salal).

iv) Metka

Q5***)What are the important industrial minerals of Jammu and Kashmir?***

Ans.The important industrial minerals available and their occurrence is as follows:

Name	Region where found
a) Borax	Pagga Valley (Ladakh)
b) Cement Stone	Wuyan (Kashmir), Reasi and Basohli (Jammu)
c) China Clay	Chakhar, Tikri, Salal, Jangalgali (Jammu)
d) Gypsym	Ramban, Batote, Good GulabGarh (Jammu), Lachhipura, KathuaNullah, Baramullah, Anantnag (Kashmir).
e) Graphite	Braripora, Uri, Karnah, Malogam, Piran (Kashmir), Kishtwar (Jammu)
f) Ochire	Nurkhawan, Ratasar, Jhaggi(Kashmir)
g) Mica	Doda, Ramban, Reasi (Jammu)
h) Sulphur	Pagga Valley (Ladakh), Anantnag,Khrew (Kashmir), Rajouri (Jammu).
i) Slate	Ramsu, Banihal ,Ramban (Jammu) , Baramullah (Kashmir).
j) Asbestos	Kargil
k) Marble	Drugmulla, Zirhaina, Oura, Trehgam (Kashmir) ,Thatri (Jammu).

Q6)*Write a detailed note on petroleum.*

Ans. The name petroleum is derived from a Greek word "petra" meaning "rock" and "oleum" meaning oil signifying that it occurs under the earth's crust trapped in rocks. It is a dark coloured viscous, strong smelling liquid which is a natural product and is obtained from oil wells. The crude oil or petroleum is a complex mixture of several solid, liquid and gaseous hydrocarbons .mixed with water, salt and other particles. Petroleum is lighter than water and is insoluble in it.

Formation of petroleum:- Refer to textual question (Q8)

Mining or extraction of petroleum:-Petroleum is obtained by drilling holes called oil wells into the earth's crust where the presence of oil has been predicted by survey. The oil wells are drilled by using drilling rigs (a drilling rig is a large structure with equipment for drilling an oil well). When a well is drilled through the rocks, natural gas comes out first with great pressure and after some time the oil comes out by itself due to gas pressure. After the pressure has subsided, the crude oil is pumped out of the oil well.

The first oil well was drilled in Pennsylvania (U.S.A) in 1859. In India oil was first drilled out at Makum in Assam.

Oil Production in India:-Some of the places where petroleum is being produced from oil wells are:-

• Ankleshwar and Kalol in Gujarat. RudraSagar and LakwaIn Assam. Offshore Areas Of Bombay High.

• Delta's Of Cavary, Krishna and Godavari.

Exploration for more oil is going on under the super vision of oil and natural gas corporation(ONGC) throughout the country.

Refining Of Petroleum:-Refer to Additional questions (Q2)

Q7)*What is L.P.G? Give its advantages.*

Ans.. L.P.G (Liquefied Petroleum Gas) It is petroleum gas which is liquefied under pressure. In L.P.G, butane is present in very large quantity and some compounds of ethyl mercaptan is added to it in order to detect its leakage.

Advantages of L.P.G

1. It can burn easily.
2. It has a high calorific value.
3. It burns with less smoky flame and does not pollute the air.
4. It does not produce poisonous gases.
5. It does not leave any ash or solid residue on burning.

Q8)*Write a detailed note on natural gas.*

Ans. Natural gas:- It is also a fossil fuel and is formed under the earth by the decomposition of vegetable matter lying under water. This decomposition is carried out by anaerobic bacteria in absence of air.Natural gas mainly consists of 95% of methane (CH_4) with small quantities of ethane (C_2H_6) and propane (C_3H_8). It occurs deep under the earth's crust either alone or along with oil above the petroleum deposits.In India, natural gas has been found in Tripura, Rajasthan, Maharashtra and In Krishna Godavari Delta.

Q9)*How is CNG formed and give its advantages?*

Ans. When natural gas is compressed under high pressure, it forms compressed natural gas which is written in short form as CNG. CNG is easier to store, transport and use.

Advantages of using CNG

1. CNG is a cleaner fuel because it burns easily and produces a lot of heat. Moreover, it burns with a smokeless flame and causes no air pollution. It also does not produce any poisonous gases on burning and does not leave behind any solid residue.

2. CNG is a complete fuel in itself and can be used directly for heating purpose in homes and in industries. There is no need to add anything else to it.

3. A great advantage of natural gas is that it can be supplied to homes and factories through a network of underground pipes. Such a network of pipe lines exists in vadodra in Gujarat, in some parts of Delhi and a few other places.

Q10)List some of the uses of natural gas.

1) It is used as a domestic and industrial fuel.

2) It is used as a fuel in thermal power stations for generating electricity.

3) CNG is used as a fuel in transport vehicles in place of petrol and diesel.

4) It is used as a source of hydrogen gas needed to manufacture fertilizers.

5) It is used as a starting material for the manufacture of no. of chemicals which are called as petrochemicals.

Q11)*Why should we use fossil fuel only when absolutely necessary?*

Ans. We should use fossil fuels only when absolutely necessary because:

1. It will ensure the availability of fossil fuels for a larger period of time.

2. It will reduce air pollution and lead to a cleaner environment.

3. It will reduce the risk of global warming.

Q12)*What are the various tips given by petroleum Conservation Research Association (PCRA) for minimizing the wastage of petrol and diesel while driving vehicle?*

Ans. The various tips are:-

1. Drive a vehicle at a constant and moderate speed as far as possible.

2. Switch off the vehicle's engine at traffic lights or at a place where a person has to wait.

3. Ensure correct air pressure in the tyres of the vehicles.

4.Ensure regular maintenance of the vehicles.

Project work;

• Make a model of candle flame depicting its various zones.

• Collect at least ten samples of various minerals.

Textual Questions

Ql What are the advantages of using CNG and LPG as fuels?

Ans. The advantages of using CNG and LPG as fuels are:

i) It is a non-polluting fuel for vehicles as it does not produce much smoke.

ii) It is used for power generation.

iii) It can be used directly for burning in homes and factories.

Q2)Name the petroleum product used for surfacing of roads.

Ans. "Bitumen" is a petroleum product which is used for surfacing of roads.

Q3) Describe how coal is formed from dead vegetation. What is this process called?

Ans. Coal was formed in prehistoric times some 200 million year ago. It was formed when huge dense forest area got buried under the surface of earth due to natural calamities such as floods, earthquakes, volcanic eruptions etc. Under humid and hot conditions, they were attacked by anaerobic bacteria which removed hydrogen and oxygen leaving behind carbon.Due to very high temperature and pressure of the earth, the carbon got compact to form stony residue called as coal.This process is called as carbonisation which is defined as the slow conversion of wood into coal by biochemical processes extending over millions of years.

Q6) Explain why fossil fuels are exhaustible natural resources?

Ans.Fossil fuels are exhaustible natural resources because it takes millions of years for its foundation and cannot be renewed over a short period of time. Furthermore, they are limited in nature and are not used with absolute care by humans.

Q7) *Describe characteristics and uses of coke.*

Ans. Coke is formed by the destructive distillation of coal. It is tough, porous and black substance. It is the purest form of carbon as it contains 95-98% carbon. It is a clean fuel than coal as it does not emit much smoke on burning.

Uses:-

- It is used in the manufacture of steel.
- It is used in metallurgy for extracting metals.

Q8)*Explain the process of formation of petroleum***.**

Ans. It has been derived from Latin word 'petra' meaning rock and

'oleum' meaning oil. So petroleum literally means rock oil because it is found trapped between two impervious rocks. Millions of years ago, very large number of microscopic plants and animals lived in sea. They died because of some calamity and their bodies sank to the bottom of the sea. These dead bodies then got covered by mud and sand. Thus, the bodies of dead plants and animals decayed in absence of air under very high temperature and pressure of earth, which resulted in the formation of petroleum and natural gas. Petroleum gas got trapped between two layers of impervious rocks and natural gas got collected above it under high pressure.

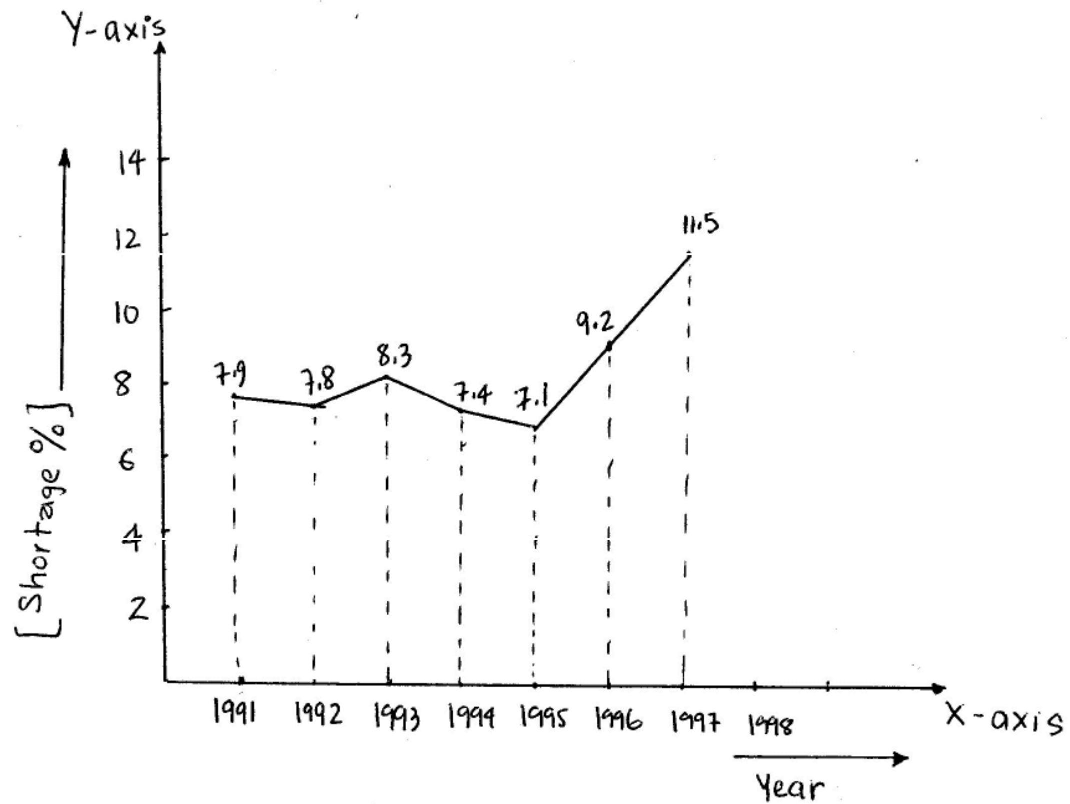
Q9)*The following table shows the total power shortage in India from*

1991- 1997. Show the data in the form of a graph, plot shortage

percentage for the years on the Y-axis and the year on X-axis.

S.NO	Year	Shortage (%)
1	1991	7.9
2	1992	7.8
3	1993	8.3
4	1994	7.4
5	1995	7.1
6	1996	9.2

7	1997	11.5



Q10) What are exhaustible natural resources? Give examples.

Ans. The resources that are present in limited quantity in nature, and can get exhausted by human activities. For example, coal, petroleum,minerals, forests etc.

Q11)What are inexhaustible natural resources? Give examples.

Ans. The resources that are present in unlimited quantity in nature and cannot get exhausted by human activities. For example air, sunlight etc.

Q12)Why is natural gas called as a clean fuel?

Ans. Natural gas is called as clean fuel because it is less polluting. It does not produce smoke on burning.

Q13)What are the uses of coal?

Ans. Coal is black, hard stone. When it is subjected to destructive distillation, it produces a number of valuable products such as coke,coal gas, coal tar which are then put to various uses.

Uses of coal are:

i) It is used as a household fuel.

ii) It is used to produce steam in railway engines.

iii) It is used to produce electricity in thermal power plants.

iv) It is used as an industrial fuel.